

Large-scale biogeophysical interactions between climate and vegetation cover

Victor Brovkin

Max-Planck institute for Meteorology, Hamburg, Germany
victor.brovkin@mpimet.mpg.de

Processes in terrestrial ecosystems, to large extent, are controlled by climate and CO₂ concentration. In turn, geographical distribution of vegetation cover strongly affects heat, moisture, and momentum fluxes between land surface and atmosphere. These interactions form different feedback loops between terrestrial biosphere and climate, which modulate substantially the climate system dynamics on different time scales. Research on climate-vegetation interactions is mostly concentrated on “hot spots” where the interaction is the most significant: boreal forests, North Africa, and Amazon forest. Boreal forests, even deciduous ones, significantly reduce the albedo of snow-covered surfaces. Boreal deforestation cools the climate, but positive feedbacks between forest and surface air temperature in the boreal region are not strong enough to establish multiple steady states. In general, the climate models agree that tropical deforestation exerts a net regional warming while a global effect on climate is less certain. In the Sahel/Sahara region, several models are able to simulate „green Sahara“ phenomenon during the mid-Holocene, which is partly attributed to a strong interaction between vegetation and monsoon precipitation. Other examples of vegetation-atmosphere interactions in the most recent climate model intercomparison (CMIP5) and plans for the next model intercomparison (CMIP6) will be presented.